REMARKS:

Claims 1-6 and 53 -57 remain in the case. Claim 1 has been amended to clarify that the subject invention comprises an isotropic transparent and non-birefringement polymer film formed from a homogeneous mixture of an optical epoxy and a reactive mesogen subsequently cured, the film comprising polymerized liquid crystal molecules randomly oriented but which are capable of being subsequently aligned.

Claims 1-6, 53 and 54 have been rejected as obvious under 103(a) as being unpatentable over Shiota et al in that Shiota discloses an isotropic film alignment layer for a liquid crystal device comprising a cured transparent and non-birefringent polymer film formed from an epoxy and a reactive mesogen comprising liquid crystals randomly oriented, the polymerized liquid crystals at an exposed surface of the polymer film capable of being subsequently aligned. It is respectfully submitted that the Shiota composition is not properly described by the examiner and that there is a basic patentable distinction between the claimed invention and the materials described in Shiota. The examiner has mistakenly interpreted the Shiota composition of a randomly oriented liquid crystal polymer network (col 5., line 62-col 6, line 9) as being an isotropic medium capable of subsequent alignment. The material prepared by Shiota uses only liquid crystal monomers, which may include mesogenic diacrylates and mesogenic epoxy. They were all polymerized in their mesogenic (birefringent) state. This film has NO orientation if polymerized in the absence of an electrical field and therefore is not equivalent to applicants' material. On the other hand, if polymerized in the presence of an electrical field an oriented, birefringent film is formed. The film without orientation has many small domains pointing in random directions. While each of the individual small domains may have internal orientation, the bulk film is without any orientation and appears turbid between crossed polarizers. It is well known by those skilled in the art that such films can not be used as alignment layers for aligning liquid crystals and they are not capable of being subsequently aligned, particularly by rubbing.

In contrast, applicants' film is formed by polymerizing a reactive liquid crystal material (a reactive mesogen), such as a diacrylate, with an optical (not liquid crystal) UV curable epoxy (Specification, page 6, lines 12 - 14). In its natural state, it is isotropic but the order parameter is NOT zero. Applicants' film as polymerized does show orientation.

It is respectfully submitted that a basic principle of liquid crystal behavior, well accepted in the art, is that an isotropic composition of mesogens comprises the liquid crystals in a disordered arrangement, or a bulk unaligned state. In other words, the liquid crystal molecules are positioned randomly, very much like liquids. When they are converted to their anisotropic or ordered phase the molecules are aligned in a crystalline-like manner. Prior but different compositions, such as polyimide based alignment films demonstrate the ability to be ordered or aligned after formation by rubbing (Spec., page 3, lines 8-15). However, because of the techniques necessary to form these films, which include solvent damage to other components in an assembly, polyimide alignment layers have limited utility. Applicants have discovered and claim an isotropic film formed from a homogeneous mixture of reactive mesogen and optical (i.e., not mesogenic) epoxy having an exposed surface in which molecules can be ordered or aligned, for example by rubbing, after polymerization of the film is complete. The composition of the reactive mesogen/optical epoxy comprising the film is the same in the bulk of the film as at the surface, the distinction being that the polymeric liquid crystal molecules within the surface can be subsequently ordered/aligned after formation of the film. Applicants' films, alignable after formation, are unique in that they can be readily formed and deposited without negatively affecting the other layers or components of the device. As set forth in the specification and shown in Figure 2, the optical epoxy and reactive mesogen in one embodiment are dissolved in a solvent, the mixture is cast on a substrate, the solvent is removed and the liquid crystal monomer/optical epoxy in the layer is photopolymerized. The desired alignment of the molecules in the alignment layer (page 6, line 28 - page 7, line 6 and the 4th step of Fig. 2) is subsequent accomplished by brushing the exposed surface, ordering the molecules in the surface of the film (page 9, line 24-25; page 14, lines 22-31, page 16, lines 17-19).

In contrast, the Shiota film is either isotropic, accomplished by photopolymerization without an electrical field, or anisotropic accomplished by photopolymerization while under the influence of an electrical field. The Shiota liquid crystalline composition is not capable of being converted from an isotropic film to an anisotropic film <u>after</u> polymerization. When Shiota uses an epoxy it is a mesogenic and not and optically grade epoxy. Shiota films do not have the same composition and therefore they can not be expected to function in the same manner as applicants' claimed invention. In other words, the cited reference does not teach, nor would it be obvious, to polymerize to form an isotropic film which is capable of

subsequently being aligned or ordered, such as set forth in applicant's claims, for example by rubbing. The Shiota film must be aligned during polymerization.

Accordingly, it is respectfully submitted that claim 1 is clearly patentable over Shiota and Shiota does not show or suggest applicant's claimed invention. Further, since claims 2-6 and 53-57 are dependent on allowable claim 1, they are likewise allowable.

Claims 1-4, 6 and 53-57 were rejected under 35 USC §103(a) as being obvious, based Akashi et al (US Patent 5,891,357) in that Akashi et al discloses a cured transparent and non-birefringent polymer film that can be formed from an epoxy as a cross-linker and an epoxy as a binder and a reactive mesogen in a mixture, the liquid crystals at the surface being capable of subsequent alignment because they are the same materials as claimed by applicant.

Akashi et al forms a heterogeneous, not homogeneous film. Still further, there is no showing in Akashi that the films produced have liquid crystals in the surface capable of being subsequently aligned or would produce such a capability in the films which clearly have their ordering and orientation fixed on polymerization and not changeable after polymerization as claimed by applicants.

Akashi is directed to a very specific construction which has improved light scattering characteristics accomplished by providing a cross-linked macromolecular liquid crystal in a granular form dispersed in a binding resin (col 4, lines 11-24). The '357 patent discloses that the mesogen monomer may be copolymerized with a cross-linking monomer which may include a polyfunctional epoxy compound (col 6, lines 24-61). It is also disclosed (Example 1) that the macromolecular liquid crystal composition may be formed by dissolving the monomers in a solvent, such as MEK, for polymerization of the monomers. However, the optical properties of the resultant macromolecule is neither disclosed nor suggested. To use the resultant polymer it must be ground up and the granules then dispersed in a resin binder to produce discrete (macro) particles of the liquid crystals, as distinguished from molecules of the polymer homogeneously dispersed in the binder. The solvent dispersion technique disclosed has a similar result. The resin binder may be an epoxy resin (Col 8, line 38-50). Films prepared from this dispersion have a cloudy appearance and cause light to scatter strongly (col 11, lines 64-65; col 12, lines 15-16 and 54-56; col 13, lines 17-19). Accordingly, the reference teaches forming a mesogen/epoxy copolymer which is granulated and dispersed in a binder or a granulated macromolecular liquid crystal dispersed in a binder which, in either case may be an epoxy resin. In no event does the reference teach

polymerized liquid crystals and epoxy molecules homogeneously distributed on a molecular level in the film, which can only result when the epoxy and reactive mesogen are mixed prior to polymerization of the reactive mesogen, resulting in a transparent and non-birefringent film (page 8, line21-27) which can subsequently be ordered. The Akashi reference teaches the exact opposite effect - a film with a cloudy appearance (anisotropic) and which causes light to scatter strongly that can be reversibly rendered clear (isotropic) by application of heat (col14, lines 5-15). Applicant produces a clear film (isotropic) which can be aligned after formation.

Accordingly, it is respectfully submitted that Akashi teaches an anisotropic film with optical characteristics completely opposite to those claimed by applicant.

It is respectfully submitted that claim 1 is clearly patentable over Akashi et al and Akashi et al does not show or suggest applicant's claimed invention. Further, since claims 2-4, 6 and 53-57 are dependent on allowable claim 1, they are likewise allowable.

Claims 1-6 and 53-57 remain in the application. It is respectively submitted that these claims are patentable, fully supported by the Specification and not shown by the prior art. It is requested that the claims be found to be patentable and a Notice of Allowance be issued.

Respectfully submitted,

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